



# झारखण्ड गजट

## असाधारण अंक

### झारखण्ड सरकार द्वारा प्रकाशित

संख्या 317 राँची, गुरुवार 19 आषाढ़ 1936 (श०)  
10 जुलाई, 2014 (ई०)

#### कृषि एवं गन्ना विकास विभाग ।

अधिसूचना

9 जुलाई, 2014

**संख्या-1999**--कृषि एवं गन्ना विकास विभाग तिथि 9 जुलाई, 2014 झारखण्ड कृषि सेवा (भर्ती एवं प्रोन्नति) नियमावली, 2013 की कंडिका-21.3 एवं 22 में निहित शक्ति का प्रयोग करते हुए झारखण्ड कृषि सेवा (भर्ती एवं प्रोन्नति) नियमावली, 2013 की कंडिका-8.2 में संलग्न पाठ्यक्रम को विलोपित करते हुए उसके स्थान पर संशोधित पाठ्यक्रम निम्न रूप से प्रतिस्थापित किया जाता है :-

क्र०	विषय	पूर्णांक	समय	अभ्युक्ति
1	2	3	4	5
1	<p><u>प्रथम पत्र- सामान्य ज्ञान:</u></p> <p>1. <b>विज्ञान:-</b> भौतिकी, रसायन विज्ञान एवं जीव विज्ञान।</p> <p>2. <b>इतिहास:-</b> प्राचीन भारत, मध्यकालीन भारत एवं आधुनिक भारत।</p>	300	3 घंटा	सभी अभ्यर्थी के लिए अनिवार्य

	<p>3. भूगोल:- भौतिक भूगोल, भारत एवं विश्व का भूगोल।</p> <p>4. भारतीय अर्थव्यवस्था</p> <p>5. भारत का संविधान</p> <p>6. खेल एवं कला संस्कृति(झारखण्ड से संबंधित)</p> <p>7. भारत एवं विश्व का सामसामयिक घटनाक्रम</p> <p>(सभी 10 + 2 स्तर का)</p>			
2	<p><u>द्वितीय पत्र-</u></p> <p><b>समूह "क"</b></p> <p>I. <u>कोटि-1(शष्य)-</u> Introductory Agriculture, Principles of Agronomy, Field Crops, Weed Management, Water Management, Soil Fertility and Fertilizer, Problem Soils, Dryland Agronomy, Sustainable Land use System etc.</p> <p>II. <u>कोटि-3 (कृषि रसायन)-</u> Soil, Essential plant nutrients,</p> <p>III. <u>कोटि-5 (पौधा संरक्षण)-</u> Principals of plant Pathology, Plant Pathogens, Insect Ecology, Integrated Pest Management &amp; Beneficial Insects, Crop Pests and Stored Grain Pests and their Management etc.</p> <p><b>समूह "ख"</b></p> <p>I. <u>कोटि-2(कृषि अभियंत्रण)-</u> Surveying and levelling, Hydrology,</p> <p><b>समूह "ग"</b></p> <p>I. <u>कोटि-7 (उद्यान)-</u> Horticulture, Production Technology of Fruit Crops, Forestry, Agriculture Science etc.</p> <p><b>समूह "घ"</b></p> <p>I. <u>कोटि-8 (माप-तौल एवं विपणन)-</u></p> <p>Science (Physics)/Agricultural Science/Engineering-</p> <p><b>A. Science (Physics):</b></p> <p>Paper-I: Mechanics, Thermal Physics and Waves and Oscillation-Mechanics, Thermal Physics, Waves &amp; Oscillations etc.</p>	300	3 घंटा	प्रत्येक समूह के अभ्यर्थी के लिए उनका कोई एक विषय

	Paper-II: Electricity & Magnetism, Physics and Electronics Electricity & Magnetism, Modern Physics and Electronics etc. <b>B. Agricultural Science:</b> <b>C. Agriculture Engineering:</b> <b>समूह "ड."</b> I. <b>कोटि-9(सांख्यिकी)</b> -Statistic, Mathematics, Agriculture Economics etc.			
3	साक्षात्कार/मौखिक परीक्षा	100		
	कुल योग	700		

2. झारखण्ड कृषि सेवा (भर्ती एवं प्रोन्नति) नियमावली, 2013 में अनुसूचि-II (Annexure-II) निम्न रूप से जोड़ा जाता है :-

### अनुसूचि- II

#### (Syllabus for Jharkhand Agriculture Services)

#### Second Paper

#### Group – “A” (समूह “क”)

#### Category-1: Agronomy (कोटि-1: शष्य)

**Introductory Agriculture:** Importance of agriculture in National economy; Evolution of Indian Agricultural Research System-evolving concerns, agricultural research and education; National Agricultural Research System-ICAR, Crop Research Institutes (National and International), National Research Centers, AICRPs, SAUs; Factors affecting crop production (genetic, environmental, edaphic and biotic factors); Agro-climatic zones of India and Jharkhand. Agronomic classifications of crops and their economic importance; Major crops of India and Jharkhand; Integrated farming system approach, sustainable agriculture, organic farming concept.

**Principles of Agronomy:** Agronomy—meaning, definition, scope; Basic principles of crop production; Tillage- modern concept of tillage, Seed- quality, importance, characteristics of good seed, seed treatment; Crop establishment- crop growth, plant population and geometry, time of sowing, depth of

sowing, establishment techniques- nursery planting and sowing techniques; Intercultural operations; Soil fertility and soil productivity; need of water and weed management; Harvesting and post-harvest processing- principles; Rainfed farming- definition, problems and prospects, classification of rainfed area in India and Jharkhand; Principles of cropping system- monocropping, multiple cropping, intercropping, mixed cropping, crop rotation, precision farming.

**Field Crops:** Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield, Cereals (rice, wheat, maize, sorghum, barley, pearl millet and minor millets); Pulses (pigeonpea, mungbean, urdbean, chickpea, lentil and peas), Oilseeds (groundnut, niger, sesame, soybean, rapeseed & mustard, sunflower, safflower and linseed), Sugar crops (sugarcane and sugarbeet); Medicinal and aromatic crops (mentha, lemon grass, citronella, palma rosa, isabgol and posta), Commercial crops (potato and tobacco), Fibre crops- (cotton, jute and sunhemp), and Forage crops(sorghum, maize, cowpea, cluster bean, napier, berseem, Lucerne and oat).

**Weed Management:** Principles of weed management, classification, biology and ecology of weeds, crop-weed competition and allelopathy; Concepts and methods of weed control, integrated weed management, classification, formulations, selectivity and resistance of herbicides, herbicide persistence in soil and plants; Application methods and equipments; Shift of weed flora in cropping systems; Aquatic and problematic weeds and their management in cropped and non-cropped situations; Weed management in field crops.

**Water Management:** Principles of irrigation; Water resources and irrigation development in India; Water and irrigation requirements; Concepts and approaches of irrigation scheduling; Methods of irrigation; Measurement of irrigation water, application, distribution and use efficiencies; Conjunctive use of water, irrigation water quality and its management; Water management in major field crops (rice, wheat, maize, groundnut, sugarcane); Agricultural drainage.

**Soil Fertility and Fertilizer Use:** Essential plant nutrients and their deficiency symptoms, concept of essentiality of plant nutrients, Indicators of soil fertility and productivity, Fertilizer materials and their availability to plants, slow release fertilizers; Nitrification inhibitors; Principles and methods of fertilizer application; Integrated nutrient management, site specific nutrient management.

**Problem soils:** Problem soils and their distribution in India; Characteristics and reclamation of these soils; Crop production techniques in problem soils.

**Dryland Agronomy:** Characteristics of Dryland farming and delineation of Dryland tracts, constraints of Dryland farming in India, Types of drought and their management, contingency crop planning and midseason corrections for aberrant weather and its recycling. Watershed management.

**Sustainable Land Use Systems:** Sustainable agriculture: parameters and indicators; Conservation agriculture, safe disposal of agri-industrial waste for crop production; Agro-forestry systems, shifting cultivation, alternate land use systems; Wastelands and their remediation for crop production.

**Category-3: Agricultural Chemistry (कोटि-3: कृषि रसायन)**

**Soil:** Pedological and edaphological concepts, origin of earth, earth's crust; Soil as a medium for plant growth, composition of earth's crust, weathering of rocks and minerals, components of soil- their importance, soil profile, soil particles- physical, mineralogical and chemical nature; Mechanical analysis, Stokes law, assumptions, limitations and applications; Soil, physical properties-density, porosity, texture, soil structure and their brief descriptions; Rheological properties in soils, calculations of porosity and bulk density; Soil air-aeration, causes of poor aeration, factors affecting aeration, importance for plant growth; Soil temperature - sources and losses of soil heat. Factors affecting soil temperature, its importance in plant growth. Soil water- structure of water, soil-water-energy relationship, classifications, surface tension and movement in soil; Soil colloids- properties, structure of silicate clay minerals, sources of negative charges, properties, kaolinite, illite, montmorillonite and vermiculite, clay minerals, milli-equivalent concept, cation exchange capacity, anion exchange capacity, buffering of soils; Problem soils- acid, saline, sodic and calcareous soils – their characteristics, formation, problems and management; Irrigation water quality and its evaluation; Waterlogged soils- basic features, distinction with upland soils.

**Essential plant nutrients-** criteria of essentiality, functions for plant growth, mechanisms for movement and uptake of ions in soils and plants; Forms of nutrients in soils, deficiency symptoms on plants, luxury consumption, nutrient interactions and chelated micronutrients; Soil fertility- evaluation and management for plant growth, soil testing and fertilizer recommendations. Soil classifications- diagnostic surface and sub-surface horizons,; Soil survey- types, objectives, uses, land capability classifications; Remote sensing and its application in agriculture, SIS, GIS and GPS- basic features and uses in agriculture; Elementary concepts of radio isotopes and uses in agriculture. Soil micro-organisms, Classifications and their roles. Organic matter- decomposition, C:N ratio, mineralization and

immobilization processes, humus, role of organic matter in soil quality; Soil erosion- types and control measures; Fertilizers and manures-classifications, NPK fertilizers, micronutrients and biofertilizers, their reactions in soils, green manuring, vermicomposting; oil cakes, plant growth regulator, sewage and sludge, biogas plant, plants and animals refuge, recycling of organic wastes, composting. Soil and water pollution- sources, brief idea about different pollutants in soils and their management.

Volumetric and gravimetric analysis including complexometric methods, periodic classification of element; Basic principle of instrumental analysis including spectro-photometry (absorption and emission spectrography); Atomic structure –elementary concept of radioactivity, element and compound and common ion effect, solubility product—hydrolysis of salts, buffer solution - equivalent weights and standard solution. Elementary concepts of organic compounds- nomenclature and classifications including hydrocarbons, alcohol, aldehydes, acids and esters, carbohydrates, fats and liquids, amino acids, nucleic acids; Pesticides- their classification and uses; biopesticides and botanical pesticides.

#### **Category-5: Plant Protection (कोटि-5: पौधा संरक्षण)**

**Principles of Plant Pathology:** General principles of plant diseases management- importance, General principles- avoidance, exclusion, protection- plant quarantine and inspection, quarantine rules and regulations; Cultural methods- rouging; Eradication of alternate and collateral-hosts, crop rotation, manure and fertilizer management, mixed cropping.

Methods- heat and chemical methods, methods of application of fungicides. Host plant resistance- Application of biotechnology in plant diseases management- development of disease resistant transgenic plants through gene cloning, integrated plant disease management (IDM)- concept, advantages and importance.

**Plant Pathogens:** Introduction, important plant pathogenic organisms, different groups, fungi bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them.

**Insect Ecology, Integrated Pest Management & Beneficial Insects:** Basic concepts of Insects Ecology. Environment and its components; Effect of abiotic factors- temperature, moisture, humidity, rainfall,

light, atmospheric pressure and air currents. Effect of biotic factors- food competition, natural and environmental resistance. Ecosystem-its structural and functional aspects, biotic potential; Environmental resistance.

Classification of animal kingdom up to class, distinguishing characters up to orders in class Insecta; general organization of an insect external morphology with special reference to lepidopteran larvae, coleopteran adults, and honeybee, metamorphosis and moulting; different physiological systems; Insect-plant relationship; Insect vectors of plant diseases- identification, biology, nature of damage, and their management tactics, pests of household, medical and veterinary importance and their control; Useful and beneficial insects like honeybee, lac insect, silkworm and pollinators; Nematode taxonomy, biology of important plant parasitic nematodes and their control, entomopathogenic nematodes; Basic principles of insect and nematode pest management-cultural, biological, insecticidal, quarantine, and regulatory aspects.

Categories of pests; IPM- introduction, importance, concepts, principles and tools of IPM, cultural, mechanical, physical, legislative, biological methods of control; Chemical control- importance, hazards and limitations; Classification of insecticides; Study of important insecticides & their formulations; Botanical insecticides; Novel insecticides, Pheromones, Nicotynyl insecticides. Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic lactones, Oxadiazimes. Thiourea derivatives, pyridine azomethines, pyrroles, etc; Nematicides, Rodenticides, Acaricides and fumigants, Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control; Insecticides Act 1968- important provisions.

**Crop Pests and Stored Grain Pests and their Management:** Major insect pests and diseases of agricultural crops like Cereals (rice, wheat, maize, sorghum, barley, pearl millet and minor millets); Pulses (pigeonpea, mungbean, urdbean, chickpea, lentil and peas); Oilseed (groundnut, niger, sesame, soybean, rapeseed & mustard, sunflower, safflower and linseed); Fibre crops (cotton, jute and sunhemp); Vegetables (tomato, cole crops); Fruit crops (mango and banana) and their management principles. Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods. Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of rice, sorghum, maize, ragi, wheat, sugarcane, cotton, sunhemp, pulses, groundnut, castor, safflower, sunflower, mustard, brinjal, ladyfinger, tomato,

cruciferous and cucurbitaceous vegetables, potato, sweet potato, chillies, mango, citrus, grapevine, banana, pomegranate, guava, ber, apple, aonla, coconut, tobacco, turmeric, betelvine, onion, coriander, garlic, ginger and ornamental plants.

### **Group – “B” (समूह “ख”)**

#### **Category-2: Agricultural Engineering (कोटि-2: कृषि अभियंत्रण)**

Surveying and leveling; Hydrology, water resources in India; Efficiency in water use; Irrigation system and equipment- components of drip and sprinkler irrigation system, water conveyances and associated efficiency; Soil-plant-water relationship; Estimation of evaporation and water requirements of crop; Water harvesting and use- farm ponds and reservoirs, command area development, land use capability classification, soil erosion and its control, land shaping and grading equipment and practices, salt balance and reclamation of saline and alkaline soils, hydraulic structures,, ground water development, wells and pumping equipment, drainage of irrigated and humid areas.

Importance of farm equipments and role of mechanization in enhancing productivity and profitability of Indian agriculture; Analysis of forces, design and production of farm machinery and power units; Mechanics of tillage and traction operation, repair and maintenance of farm machines and equipments, farm engines; tractors and power tillers, tractor stability and operators comfort, field capacity and cost analysis; test codes and procedure; safety and ergonomic principles; Renewable energy- source of energy, role of energy in economic development; solar, wind and bio-energy; biogas plants and gasifiers; biofuels from biomass; collection, characterization and storage of biomass, solar cookers & solar refrigerators.

Biochemical and engineering properties of biological materials; Quality control and safety of raw and finished products; Principles, practices and equipments for drying, milling, separation and storage of agricultural produce and by-products, material handling equipments and operations, farmstead planning; heating and cooling load calculation, seed processing practices and equipments; Food preservation methods and products development; refrigeration and air conditioning; cold stores, waste management, cost analysis and food processing plants layout, feasibility reports; Protected cultivation- green house technology, types of green houses.



**Group – “C” (समूह “ग”)****Category-7: Horticulture (कोटि-7: उद्यान)****(Horticulture/Forestry/Agriculture Science) (उद्यान/वानिकी/कृषि विज्ञान)****(a)Horticulture (उद्यान)**

Definition and division of horticulture, scope, importance and problems of Horticulture; Classification of fruit, vegetable and ornamentals; Types of vegetable gardens, plant propagation techniques, layout of orchard; Principles of preservation of fruits and vegetables; Protected cultivation; Value addition and marketing of produce; Techniques of raising nursery; Basic physiology of ripening in fruits and vegetables and their products; Type of fruits and vegetable products and control of fungal and bacterial diseases, nutritive value of fruits and vegetables and their role in human nutrition, important physiological disorders.

**Production Technology of Fruits Crops:** Area and production of different fruit crops; Climatic zones of horticultural crops; Training and pruning of fruit trees. Unfruitfulness and their remedies, fruit drops and their remedies; Propagation of important fruits, methods of irrigation in fruit crops; Manuring in fruit crops.

Package of practices of cultivation of major fruits- mango, banana, citrus, guava, grape, pineapple, papaya, apple, pear, peach and plum; Cultivation of plantation crops like coconut, cashew nut, coffee, tea and arecanut.

Area and production of different vegetables, raising of seedlings, cultural practices of vegetable crops, production technology of tomato, chillies, brinjal, cucurbits (pumpkin, bottlegourd, bittergourd, ashgourd, muskmelon and watermelon, cucumber and parwal); cole crops (cauliflower, cabbage and knol khol); onion and garlic, beans, cowpea, common bean, french bean and peas; root crops (radish, tapioca, sweet potato, turnip, carrot and potato), leafy vegetables (fenugreek, coriander and spinach); importance of floriculture cultivation, ornamental gardens, types and styles of ornamental gardens, seasonal flowers, pot plants etc. Major floriculture crops grown in India for commercial purposes like rose, carnation, chrysanthemum, marigold, tuberose, gladiolus, orchids and jasmine; production technology of spices like black pepper, coriander, turmeric, ginger, cardamom, cumin and fenugreek.

Production technology of aromatic crops- lemon grass, citronella, palma rosa, vetiver, geranium, dawana; Medicinal plants- rauvolfia, ocimum, aloevera, guggul, stevia, safed musli, brahmi, tulsi, mint, kalmegh, jatropha and diascoria. Nursery raising techniques for medicinal and aromatic plants.

Establishment and maintenance of lawns, trees, shrubs, creepers, hedges and annuals; Type of gardens, methods of crop improvement; Male sterility and incompatibility; Pure line and pedigree selection, backcross, mass selection, heterosis; Plant nutrients, deficiency symptoms of nutrients, manures and fertilizers; Systems of irrigation; Management of important pests and diseases of fruits and vegetables.

### **(b) Forestry (वानिकी)**

Forest- importance, types, classification, ecosystem, biotic and abiotic components, ecological succession and climax; Nursery and planting techniques; Social forestry, farm forestry, urban forestry, community forestry; Forest management- silvicultural practices, forest mensuration, natural regeneration, man-made plantations, shifting cultivation, taungya, dendrology, hardwoods, softwoods, pulpwoods, fuelwoods, multipurpose tree species; Wasteland management; Agroforestry – importance and land use systems, forest soils, classification and conservation; Watershed management; Forest genetics and biotechnology and tree improvement, tree seed technology; Rangelands; Wildlife – importance, abuse, depletion, management; Major and minor forest products including medicinal and aromatic plants; Forest inventory, aerial photo interpretation and remote sensing, forest depletion and degradation – importance and impact on environment, global warming, role of forests and trees in climate mitigation, tree diseases, wood decay and discolouration. Tree pests, integrated pest and disease management; Biological and chemical wood preservation; Forest conservation; Indian forest policies, Indian forest act; Forest engineering, forest economics, Joint forest management and tribology.

### **(c) Agricultural Science (कृषि विज्ञान)**

**Paper-I:** Ecology and its relevance to man, natural resources, their sustainable management and conservation; Physical and social environment as factors of crop distribution and production; Agro ecology; Cropping patterns as indicators of environments. Environmental pollution and associated

hazards to crops, animals and humans; Climate change- international conventions and global initiatives. Green house effect and global warming. Advance tools for ecosystem analysis; Remote sensing (RS) and Geographic Information System (GIS).

Cropping patterns in different agro-climatic zones of the country. Impact of high-yielding and short-duration varieties on shifts in cropping patterns. Concepts of various cropping and farming systems. Organic and precision farming. Package of practices for production of important cereals, pulses, oil seeds, fibres, sugar, commercial and fodder crops.

Important features and scope of various types of forestry plantations such as social forestry, agro-forestry, and natural forests. Propagation of forest plants. Forest products. Agro forestry and value addition. Conservation of forest flora and fauna.

Weeds, their characteristics, dissemination and association with various crops; their multiplications; cultural, biological, and chemical control of weeds.

Soil- physical, chemical and biological properties. Processes and factors of soil formation. Soils of India. Mineral and organic constituents of soils and their role in maintaining soil productivity. Essential plant nutrients and other beneficial elements in soils and plants. Principles of soil fertility, soil testing and fertilizer recommendations, integrated nutrient management. Biofertilizers. Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils. Efficient phosphorus and potassium use. Problem soils and their reclamation. Soil- factors affecting greenhouse gas emission.

Soil conservation, integrated watershed management. Soil erosion and its management. Dry land agriculture and its problems. Technology for stabilizing agricultural production in rain fed areas.

Water-use efficiency in relation to crop production, criteria for scheduling irrigations, ways and means of reducing run-off losses of irrigation water. Rainwater harvesting. Drip and sprinkler irrigation. Drainage of waterlogged soils, quality of irrigation water, effect of industrial effluents on soil and water pollution. Irrigation projects in India.

Farm management- scope, importance and characteristics, farm planning. Optimum resource use and budgeting. Economics of different types of farming systems. Marketing management strategies for development, market intelligence. Price fluctuations and their cost; role of co-operatives in agricultural economy; types and systems of farming and factors affecting them. Agricultural price policy. Crop Insurance.

Agricultural extension- its importance and role, methods of evaluation of extension programmes, socio-economic survey and status of large, small marginal farmers & landless agricultural labourers. Training programmes for extension workers. Role of Krishi Vigyan Kendras (KVKs) in dissemination of agricultural technologies. Non- Government Organizations (NGOs) and self-help group approach for rural development.

**Paper-II:** Cell structure, function and cell cycle. Synthesis, structure and function of genetic material. Laws of heredity. Chromosome structure, chromosomal aberrations, linkage and cross-over, and their significance in recombination breeding. Polyploidy, euploids and aneuploids. Mutations - and their role in crop improvement. Heritability, sterility and incompatibility, classification and their application in crop improvement. Cytoplasmic inheritance, sex-linked, sex-influenced and sex-limited characters.

History of plant breeding. Modes of reproduction, selfing and crossing techniques. Origin, evolution and domestication of crop plants, center of origin, law of homologous series, crop genetic resources- conservation and utilization. Application of principles of plant breeding, improvement of crop plants. Molecular markers and their application in plant improvement. Pure-line selection, pedigree, mass and recurrent selections, combining ability, its significance in plant breeding. Heterosis and its exploitation. Somatic hybridization. Breeding for disease and pest resistance. Role of inter-specific and inter-generic hybridization. Role of genetic engineering and biotechnology in crop improvement. Genetically modified crop plants.

Seed production and processing technologies. Seed certification, seed testing and storage. DNA finger printing and seed registration. Role of public and private sectors in seed production and marketing. Intellectual Property Rights (IPR) issues, WTO issues and its impact on agriculture.

Principles of Plant Physiology with reference to plant nutrition, absorption, translocation and metabolism of nutrients. Soil - water- plant relationship.

Enzymes and plant pigments; photosynthesis- modern concepts and factors affecting the process, aerobic and anaerobic respiration; C3, C4 and CAM mechanisms. Carbohydrate, protein and fat metabolism. Growth and development; photoperiodism and vernalization. Plant growth substances and their role in crop production. Physiology of seed development and germination; dormancy. Stress physiology- drought, salt and water stress.

Major fruits, plantation crops, vegetables, spices and flower crops. Package of practices of major horticultural crops. Protected cultivation and high-tech horticulture. Post-harvest technology

and value addition of fruits and vegetables. Landscaping and commercial floriculture. Medicinal and aromatic plants. Role of fruits and vegetables in human nutrition.

Diagnosis of pests and diseases of field crops, vegetables, orchard and plantation crops and their economic importance. Classification of pests and diseases and their management. Integrated pest and disease management. Storage pests and their management. Biological control of pests and diseases. Epidemiology and forecasting of major crop pests and diseases. Plant quarantine measures. Pesticides-their formulation and modes of action.

Food production and consumption trends in India. Food security and growing population vision -2025. Reasons for grain surplus. National and international food policies. Production, procurement, distribution, constraints. Availability of food grains, per capita expenditure on food. Trends in poverty, Public Distribution System and Below Poverty Line population, Targeted Public Distribution System (PDS), policy implementation in context to globalization. Processing constraints. Relation of food production to National Dietary Guidelines and food consumption pattern. Food- based dietary approaches to eliminate hunger. Nutrient deficiency Micro nutrient deficiency. Protein energy malnutrition or Protein Calorie Malnutrition (PEM or PCM), Micro nutrient deficiency and HRD in context of work capacity of women and children. Food grain productivity and food security.

### **Group – “D” ( समूह- “घ”)**

#### **Category-8: Measurement and Marketing (कोटि- 8: माप-तौल एवं विपणन)**

#### **Science (Physics)/Agricultural Science/Engineering**

{विज्ञान(भौतिकी/कृषि विज्ञान/ कृषि अभियंत्रण)}

#### **a. Science (Physics) (विज्ञान : भौतिकी)**

#### **Paper-I: Mechanics, Thermal Physics and Waves and Oscillation**

**Mechanics:** Conservation Laws, Collisions, impact parameter, scattering cross-section, centre of mass and lab systems with transformation of physical quantities, Rutherford Scattering. Motion of a rocket under constant force field. Rotating frames of reference, Coriolis force, Motion of rigid bodies. Angular momentum, Torque and precession of a top, Gyroscope, Central forces, Motion under inverse square law. Kepler’s Laws, Motion of Satellites (including geostationary). Galilean Relativity, Special Theory of Relativity, Michelson-Morley Experiment, Lorentz Transformations- addition theorem of velocities,

Variation of mass with velocity, Mass-Energy equivalence. Fluid dynamics, streamlines, turbulence, Bernoulli's Equation with simple applications.

**Thermal Physics:** Laws of thermodynamics, Entropy, Carnot's cycle, Isothermal and Adiabatic Changes, Thermodynamic Potentials Maxwell's relations. The Clausius-Clapeyron equation reversible cell, Joule-Kelvin effect etc. Boltzmann Law, Kinetic Theory of Gases, Maxwell's Distribution Law of velocities, Equipartition of energy, Specific heats of gases. Mean Free path, Brownian Motion. Black Body radiation, specific heat of solid-Einstein & Debye theories, Wien's Law, Planck's Law, Solar Constant. Thermal ionization and Stellar spectra-production of low temperatures using adiabatic demagnetization and dilution refrigeration, Concept of negative temperature.

**Waves and Oscillations:** Oscillations, Simple harmonic motion, stationary and travelling waves, Damped harmonic motion, Forced oscillation & Resonance. Wave equation, Harmonic Solutions, Plane and Spherical waves, Superposition of waves, Phase and Group velocities, Beats. Huygen's principle, Interference. Diffraction-Fresnel and Fraunhofer. Diffraction by straight edge, Single and multiple slits, Resolving power of grating and Optical Instruments. Rayleigh Criterion. Polarization; Production and Detection of polarized light (linear, circular and elliptical). Laser sources (Helium-Neon, Ruby, and semiconductor diode). Concept of spatial and temporal coherence. Diffraction as a Fourier transformation. Fresnel and Fraunhofer diffraction by rectangular and circular apertures, Holography; theory and applications.

## **Paper-II: Electricity & Magnetism, Modern Physics and Electronics**

**Electricity & Magnetism:** Coulomb's Law, Electric field, Gauss's law, Electric-potential, Poisson and Laplace equations for a homogeneous dielectric, uncharged conducting Plane. Magnetic Field Magnetic induction and field strength. Biot-Savart law and applications. Electro-magnetic induction, Faraday's Lenz's laws, Self and mutual inductances. Alternating currents, L.C.R. circuits series and parallel resonance circuits, quality factor. Kirchhoff's laws with application. Maxwell's equations and electromagnetic waves, Transverse nature of electromagnetic waves, Poynting vector, magnetic fields in matter- dia, para, ferro antiferro and ferri magnetism (qualitative approach only).

**Modern Physics:** Bohr's theory of hydrogen atom. Electron spin, Optical and X-ray Spectra. Stern-Gerlach experiment and spatial quantization. Vector model of the atom, spectral terms, fine structure of spectral lines. J-J and L-S coupling, Zeeman effect, Pauli's exclusion principle, spectral terms of two equivalent and non-equivalent electrons. Gross and fine structure of electronic band Spectra. Raman effect Photoelectric effect. Compton effect, de Broglie waves. Wave particle duality and uncertainty principle. Schrodinger wave equation with application to (i) particle in a box, (ii) motion across a step potential, One dimensional harmonic oscillator eigen values and eigen functions. Uncertainty Principle Radio activity, Alpha, Beta and Gamma radiations. Elementary theory of the alpha decay. Nuclear binding energy. Mass Spectroscopy, Semi empirical mass formula. Nuclear fission and fusion. Elementary Reactor physics. Elementary particles and their classification. Strong and Weak Electromagnetic interactions. Particle accelerators: Cyclotron. Linear accelerations, Elementary ideas of Superconductivity.

**Electronics:** Band theory of Solids- conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors. P-N junction, Thermist Zenner diodes and transistors for rectification, amplification, oscillation modulation and detection of r.f. waves. Transistor receiver. Television Logic Gates.

## **b. Agricultural Science (कृषि विज्ञान)**

**Paper-I:** Ecology and its relevance to man, natural resources, their sustainable management and conservation; Physical and social environment as factors of crop distribution and production; Agro ecology; Cropping patterns as indicators of environments. Environmental pollution and associated hazards to crops, animals and humans; Climate change- international conventions and global initiatives. Green house effect and global warming. Advance tools for ecosystem analysis; Remote sensing (RS) and Geographic Information System (GIS).

Cropping patterns in different agro-climatic zones of the country. Impact of high-yielding and short-duration varieties on shifts in cropping patterns. Concepts of various cropping and farming systems. Organic and precision farming. Package of practices for production of important cereals, pulses, oil seeds, fibres, sugar, commercial and fodder crops.

Important features and scope of various types of forestry plantations such as social forestry, agro-forestry, and natural forests. Propagation of forest plants. Forest products. Agro forestry and value addition. Conservation of forest flora and fauna.

Weeds, their characteristics, dissemination and association with various crops; their multiplications; cultural, biological, and chemical control of weeds.

Soil- physical, chemical and biological properties. Processes and factors of soil formation. Soils of India. Mineral and organic constituents of soils and their role in maintaining soil productivity. Essential plant nutrients and other beneficial elements in soils and plants. Principles of soil fertility, soil testing and fertilizer recommendations, integrated nutrient management. Biofertilizers. Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils. Efficient phosphorus and potassium use. Problem soils and their reclamation. Soil- factors affecting greenhouse gas emission.

Soil conservation, integrated watershed management. Soil erosion and its management. Dry land agriculture and its problems. Technology for stabilizing agricultural production in rain fed areas.

Water-use efficiency in relation to crop production, criteria for scheduling irrigations, ways and means of reducing run-off losses of irrigation water. Rainwater harvesting. Drip and sprinkler irrigation. Drainage of waterlogged soils, quality of irrigation water, effect of industrial effluents on soil and water pollution. Irrigation projects in India.

Farm management- scope, importance and characteristics, farm planning. Optimum resource use and budgeting. Economics of different types of farming systems. Marketing management strategies for development, market intelligence. Price fluctuations and their cost; role of co-operatives in agricultural economy; types and systems of farming and factors affecting them. Agricultural price policy. Crop Insurance.

Agricultural extension- its importance and role, methods of evaluation of extension programmes, socio-economic survey and status of large, small marginal farmers & landless agricultural labourers. Training programmes for extension workers. Role of Krishi Vigyan Kendras (KVKs) in dissemination of agricultural technologies. Non- Government Organizations (NGOs) and self-help group approach for rural development.

**Paper-II:** Cell structure, function and cell cycle. Synthesis, structure and function of genetic material. Laws of heredity. Chromosome structure, chromosomal aberrations, linkage and cross-over, and their significance in recombination breeding. Polyploidy, euploids and aneuploids. Mutations - and their role in crop improvement. Heritability, sterility and incompatibility, classification and their application in crop improvement. Cytoplasmic inheritance, sex-linked, sex-influenced and sex-limited characters.



History of plant breeding. Modes of reproduction, selfing and crossing techniques. Origin, evolution and domestication of crop plants, center of origin, law of homologous series, crop genetic resources- conservation and utilization. Application of principles of plant breeding, improvement of crop plants. Molecular markers and their application in plant improvement. Pure-line selection, pedigree, mass and recurrent selections, combining ability, its significance in plant breeding. Heterosis and its exploitation. Somatic hybridization. Breeding for disease and pest resistance. Role of inter-specific and inter-generic hybridization. Role of genetic engineering and biotechnology in crop improvement. Genetically modified crop plants.

Seed production and processing technologies. Seed certification, seed testing and storage. DNA finger printing and seed registration. Role of public and private sectors in seed production and marketing. Intellectual Property Rights (IPR) issues, WTO issues and its impact on agriculture.

Principles of Plant Physiology with reference to plant nutrition, absorption, translocation and metabolism of nutrients. Soil - water- plant relationship.

Enzymes and plant pigments; photosynthesis- modern concepts and factors affecting the process, aerobic and anaerobic respiration; C3, C4 and CAM mechanisms. Carbohydrate, protein and fat metabolism. Growth and development; photoperiodism and vernalization. Plant growth substances and their role in crop production. Physiology of seed development and germination; dormancy. Stress physiology- drought, salt and water stress.

Major fruits, plantation crops, vegetables, spices and flower crops. Package of practices of major horticultural crops. Protected cultivation and high-tech horticulture. Post-harvest technology and value addition of fruits and vegetables. Landscaping and commercial floriculture. Medicinal and aromatic plants. Role of fruits and vegetables in human nutrition.

Diagnosis of pests and diseases of field crops, vegetables, orchard and plantation crops and their economic importance. Classification of pests and diseases and their management. Integrated pest and disease management. Storage pests and their management. Biological control of pests and diseases. Epidemiology and forecasting of major crop pests and diseases. Plant quarantine measures. Pesticides-their formulation and modes of action.

Food production and consumption trends in India. Food security and growing population vision -2025. Reasons for grain surplus. National and international food policies. Production, procurement, distribution, constraints. Availability of food grains, per capita expenditure on food. Trends in poverty,

Public Distribution System and Below Poverty Line population, Targeted Public Distribution System (PDS), policy implementation in context to globalization. Processing constraints. Relation of food production to National Dietary Guidelines and food consumption pattern. Food- based dietary approaches to eliminate hunger. Nutrient deficiency Micro nutrient deficiency. Protein energy malnutrition or Protein Calorie Malnutrition (PEM or PCM), Micro nutrient deficiency and HRD in context of work capacity of women and children. Food grain productivity and food security.

### **c. Agricultural Engineering (कृषि अभियंत्रण)**

Surveying and leveling; Hydrology, water resources in India; Efficiency in water use; Irrigation system and equipment- components of drip and sprinkler irrigation system, water conveyances and associated efficiency; Soil-plant-water relationship; Estimation of evaporation and water requirements of crop; Water harvesting and use- farm ponds and reservoirs, command area development, land use capability classification, soil erosion and its control, land shaping and grading equipment and practices, salt balance and reclamation of saline and alkaline soils, hydraulic structures,, ground water development, wells and pumping equipment, drainage of irrigated and humid areas.

Importance of farm equipments and role of mechanization in enhancing productivity and profitability of Indian agriculture; Analysis of forces, design and production of farm machinery and power units; Mechanics of tillage and traction operation, repair and maintenance of farm machines and equipments, farm engines; tractors and power tillers, tractor stability and operators comfort, field capacity and cost analysis; test codes and procedure; safety and ergonomic principles; Renewable energy- source of energy, role of energy in economic development; solar, wind and bio-energy; biogas plants and gasifiers; biofuels from biomass; collection, characterization and storage of biomass, solar cookers & solar refrigerators.

Biochemical and engineering properties of biological materials; Quality control and safety of raw and finished products; Principles, practices and equipments for drying, milling, separation and storage of agricultural produce and by-products, material handling equipments and operations, farmstead planning; heating and cooling load calculation, seed processing practices and equipments; Food preservation methods and products development; refrigeration and air conditioning; cold stores, waste management, cost analysis and food processing plants layout, feasibility reports; Protected cultivation- green house technology, types of green houses.

**Group “E” (समूह इ)****Category-9: Statistics (Statistics/Mathematics/Agricultural Economics)****(कोटि-9:सांख्यिकी/गणित/कृषि अर्थशास्त्र)****a. Statistics (सांख्यिकी)**

Introduction: Statistics – definition, use and limitations; Frequency Distribution and Curves; Measures of Central Tendency: Arithmetic mean; Geometric mean, Harmonic mean, Median, Mode; Measures of Dispersion: Range, Mean deviation, Quartile deviation, Variance and Coefficient of Variation; Probability: Definition and concepts, law of addition and multiplication, conditional probability, Bayes’ theorem; Binomial, multinomial, Poisson and normal distribution; Introduction to Sampling: Random Sampling; Standard Error; Tests of Significance - Types of Errors, Null Hypothesis, Level of Significance, Testing of hypothesis; Large Sample Test- SND test for Means, Single Sample and Two Samples; Student’s t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test for goodness of fit and independence of attributes; Correlation and Regression and associated tests of significance. Experimental Designs: basic principles, Analysis of variance, Completely Randomized Design (CRD), Randomized Block Design (RBD).

Computers: input, output devices, memory, hardware, software; Classification, booting computer. Viruses, worms and antivirus. Operating System- some DOS commands, FORMAT, DIR, COPY, PATH, MD, CD and DELTREE. Types of files. WINDOWS: Desktop and its elements, WINDOWS Explorer, working with files and folders; setting time and date. Anatomy of WINDOWS. Applications – MSWORD: Word processing features- Creating, Editing, Formatting and Saving; MSEXCEL: Electronic spreadsheets, concept, packages. Creating, editing and saving a spreadsheet. In-built statistical and other functions. Excel data analysis tools, Correlation and regression, t-test for two-samples and ANOVA with one-way classification. Creating graphs. MS Power Point and its features. MSACCESS: Concept of Database, creating database; Computer programming: Flow charts and Algorithms, Programming languages- BASIC, FORTRAN and C. Internet: World Wide Web (WWW), Concepts, web browsing and electronic mail. Bioinformatics - NCBI Genbank sequence database- primary and secondary database.

**b. Mathematics (गणित)**

Mathematics: Real and complex numbers; polynomial and roots; de Moivre's theorem and its applications. Elements of set theory- De Morgan's laws; vector space, linear independence, orthogonality; matrices addition and multiplication, rank of a matrix, determinants, inverse of a matrix, solution of a system of linear equations, characteristic roots and vectors; convergence of infinite sequences and infinite series tests for convergence, absolute convergence; co-ordinate geometry in two dimensions - line, circle, parabola, ellipse and hyperbola; Differential calculus: limits, differentiation of function of a single variable; Taylor's and Maclaurin's theorems, mean-value theorem; maxima and minima; indeterminate form; curvature, asymptotes, tracing of curves, function of two or more independent variables, partial differentiation, homogeneous functions and Euler's theorem, composite functions, total derivatives, derivative of an implicit function, change of variables, Jacobians. Integral calculus: integration by simple methods, standard forms, simple definite integrals, double integrals, change of order of integration, Gamma and Beta functions, application of double integrals to find area. Ordinary differential equations: differential equations of first order, Exact and Bernoulli's differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut's equation, methods of finding complementary functions and particular integrals. Calculus of finite differences, interpolation; numerical differentiation and integration, difference equations; solution of simple non-linear equations by numerical methods like Newton- Raphson method.

**c. Agricultural Economics (कृषि अर्थशास्त्र)**

Theory of consumer behavior, theory of demand, elasticity of demand, indifference curve analysis, theory of firm, cost curves, theory of supply, price determination, market classification, concept of macroeconomics, money and banking, national income. Agricultural marketing—role, practice, institutions, problems and reforms, role of capital and credit in agriculture, crop insurance, credit institutions, cooperatives, capital formation in agriculture, agrarian reforms, globalization, WTO & its impact on Indian agriculture.

Basic principles of farm management, concept of farming system and economics of farming systems, agricultural production economics-scope and analysis, factor-product relationship, marginal

cost and marginal revenue, farm planning and budgeting, Agricultural finance: nature and scope. Time value of money, Compounding and discounting. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4R's, 5C's and 7 P's of credit, repayment plans. History of financing agriculture in India. Commercial banks, Nationalization of commercial banks. Lead bank scheme, regional rural banks, scale of finance. Higher financing agencies, RBI, NABARD, AFC, Asian Development Bank, World Bank, role of capital and credit in agriculture; credit institutions, co-operatives and agrarian reforms in India.

2. झारखण्ड कृषि सेवा (भर्ती एवं प्रोन्नति) नियमावली, 2013 की उपरोक्त कंडिका को छोड़कर शेष कंडिका यथावत् रहेगी।

झारखण्ड राज्यपाल के आदेश से

**डॉ० नितिन मदन कुलकर्णी,**

सरकार के सचिव।

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